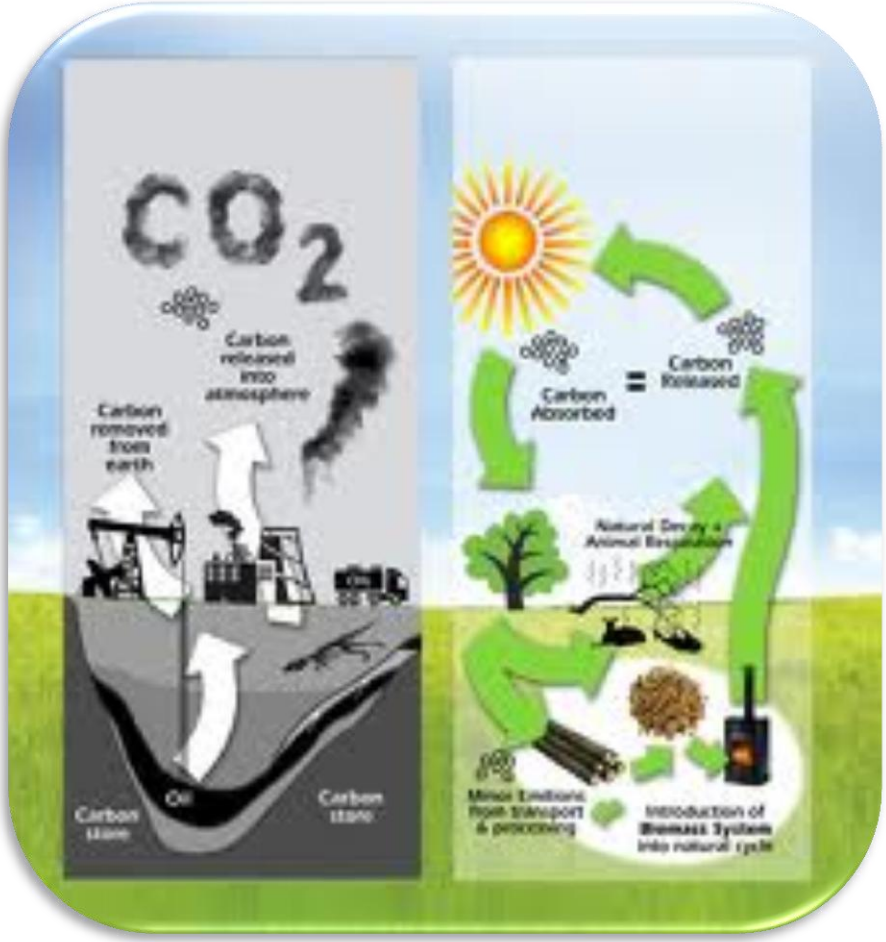
IS IT POSSIBLE TO ACT ENVIRONMENTAL FRIENDLY WHILE BOOSTING YOUR COMPETIVENESS?

CORTUS ENERGY

Environmentally sound and cost-effective renewable energy gas to the process- and power industries through our patented gasification process **WoodRoll®**.

WHY BIOMASS?

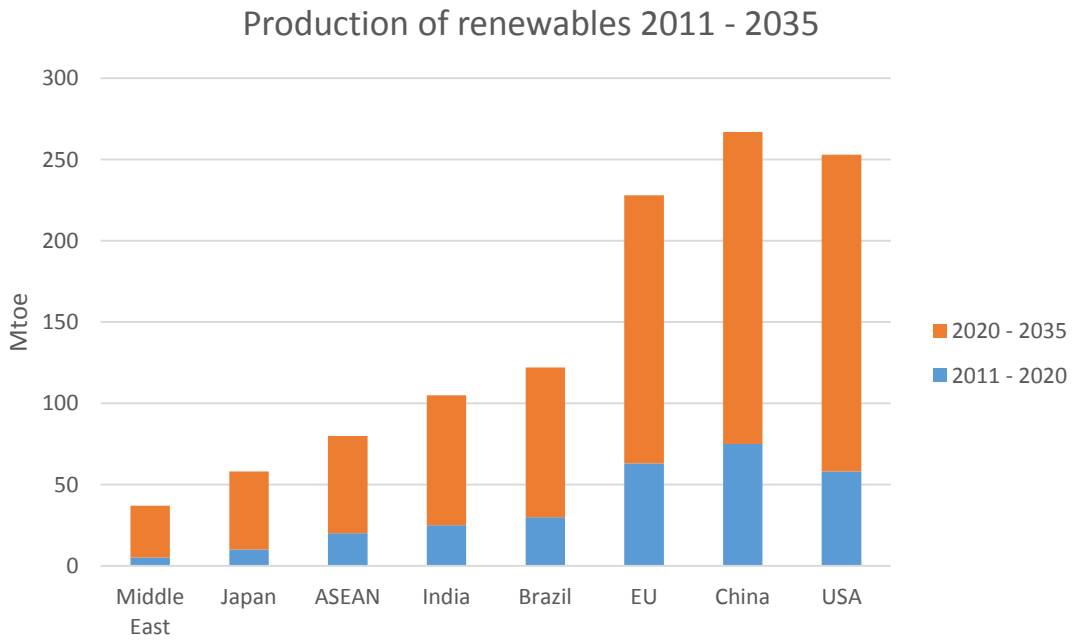


At combustion both bio- and fossil fuels release Carbon dioxide and greenhouse gases but:

- **Fossil fuels is adding its releases to the atmosphere which worsen the greenhouse effect**
- **Bio fuels does NOT add any Carbondioxide or greenhouse gases to the atmosphere**

BIOMASS – MUST INCREASE

- The global demand for energy is forecasted by the International Energy Agency (IEA) to increase by 1.6% annually to 2020 and thereafter gradually slow the growth to 1% annually by 2035
- The use of renewable energy soures must increase much faster to combat climate change and is predicted to grow much faster than the average energy demand



IEA World Energy Outlook 2013

- Gasification of biofuels has been identified as a critical technology to fulfill the needed growth of renewable energy by both IEA and UN

GASIFICATION OF BIOMASS – 2 MAIN METHODS

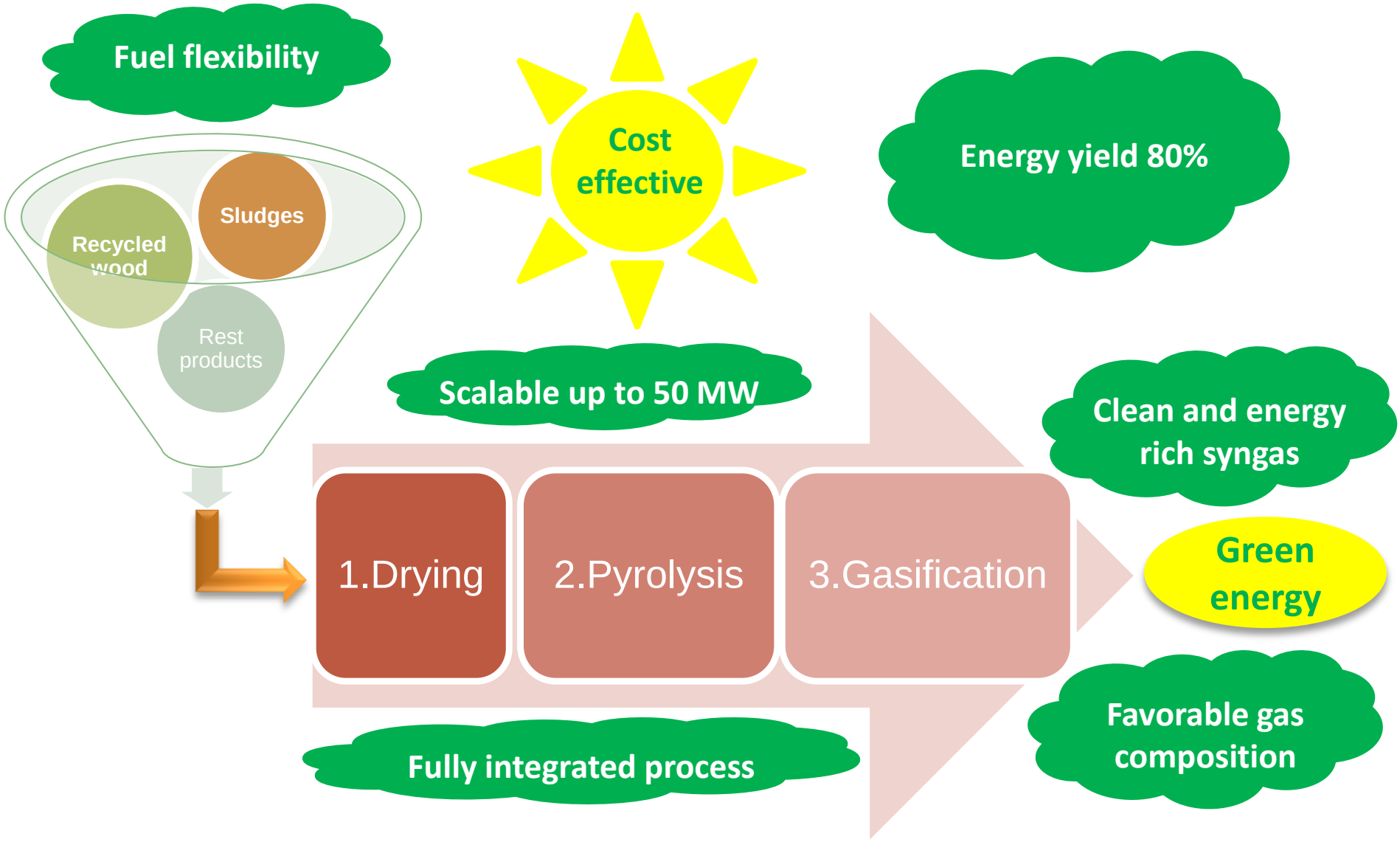
Anaerobic digestion

- Well established technology
- Fuels: manure, food waste and sludge
- Slow process, require large area → limited scale effects → no industrial solution
- Low thermal yield with high amount of byproduct (fertilizer)
- Fit: free fuel acces and need of byproduct

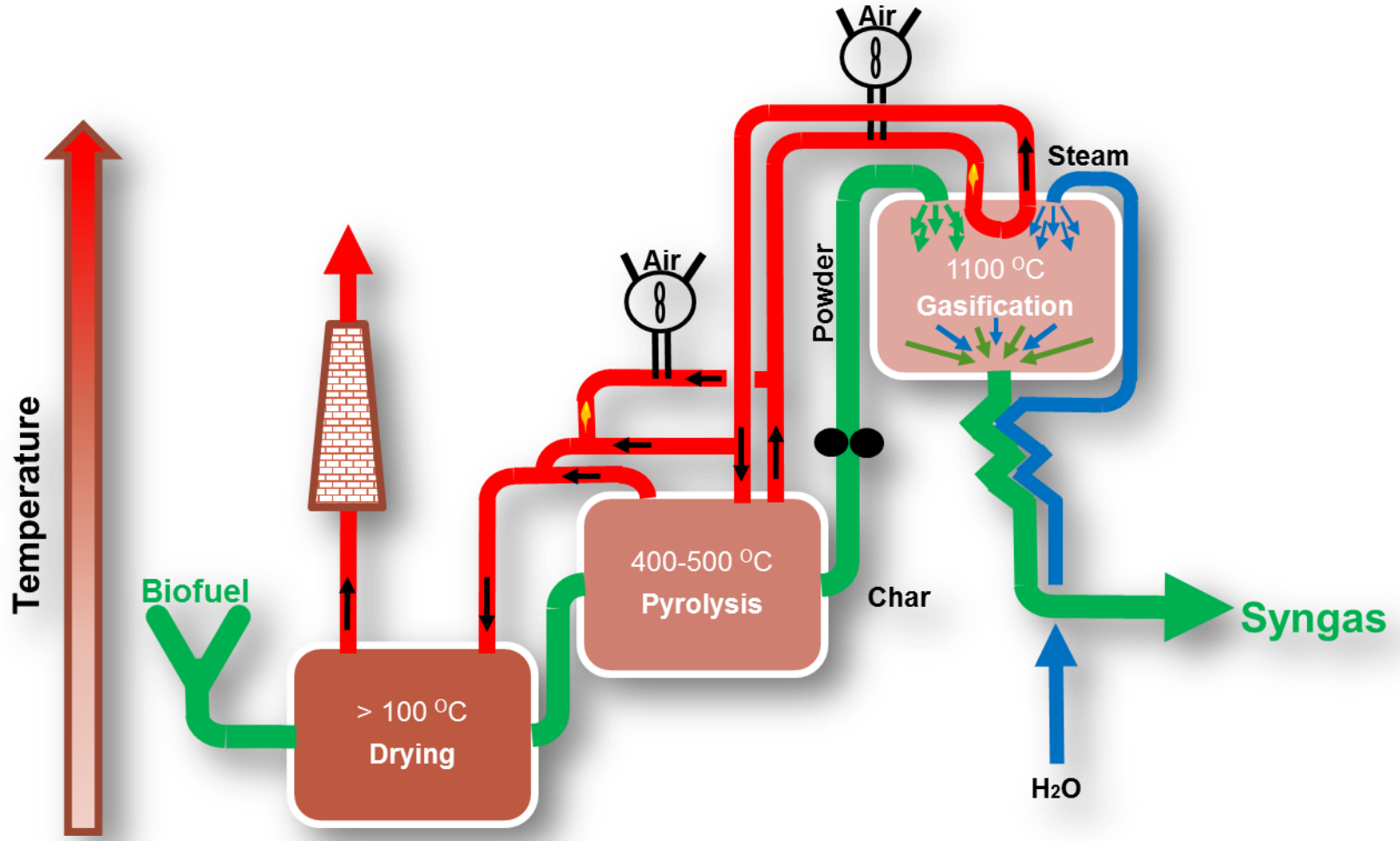
Thermal gasification

- Established concept but many different technologies exist
- Fast and continous process → scale effects → industrial solution
- Higher thermal yield, less byproduct
- Normally require specific ”customized” type of bio fuel

WOODROLL® - GASIFICATION

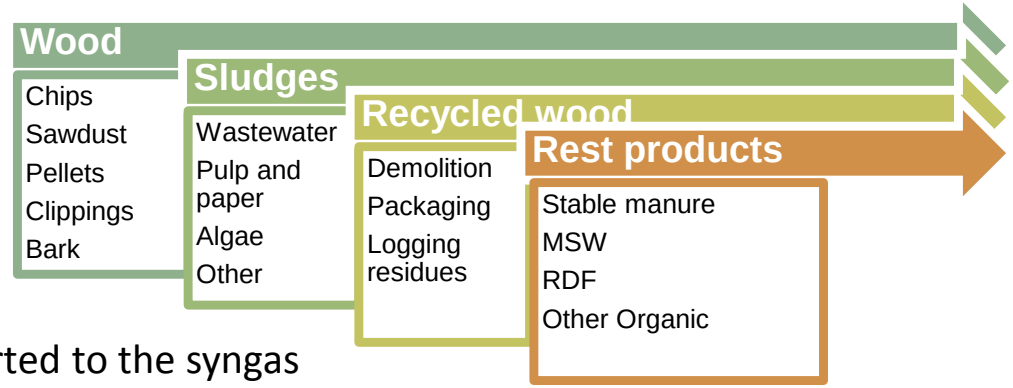


WOODROLL® - BASIC CONCEPT



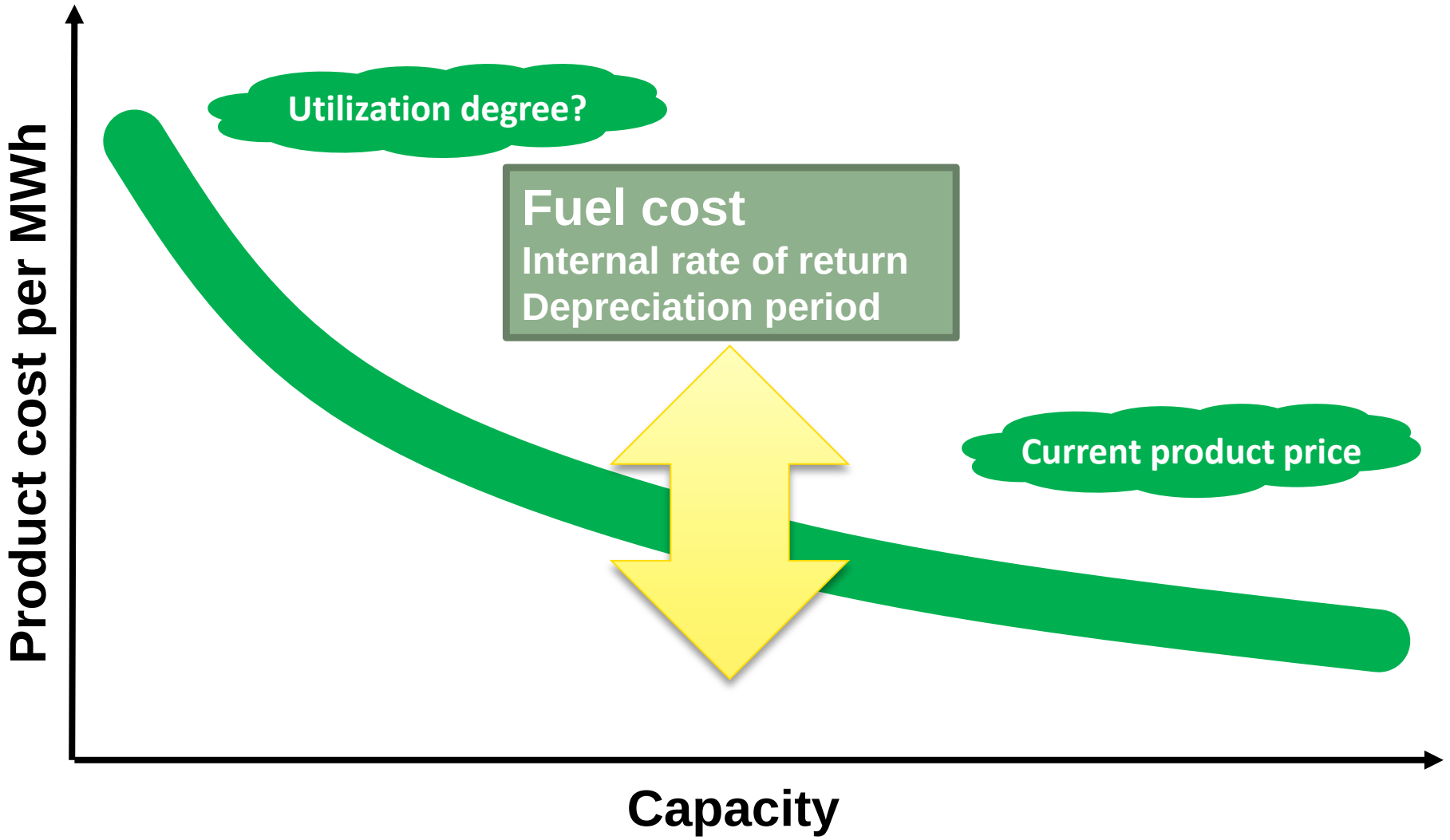
WOODROLL® - UNIQUE FEATURES

- **Fuel flexibility**
  - Use of local available bio resources
  - Use of industrial byproducts
  - Mixing of fuels
  - Change the fuel mix over time to optimize the cost of it



- **Integrated process**
  - Operator efficiency
  - Prepared for remote control
- **Thermal yield**
  - Typical 80% of the energy is converted to the syngas
  - Can be increased to 90% if heat is reovered (e.g district heating)
- **Clean syngas**
  - No need to add costly downstream gas cleaning equipment
- **Syngas composition**
  - Can be used as directly as feedstock to the petro chemical
  - High Hydrogen content (55-60%) ➔
  - Relation Hydrogen and Carbonmonoxide 1:2 optimal for Methane production

WOODROLL® - COST EFFECTIVENESS



WOODROLL® - APPLICATIONS

Industrial high temperature processes (Syngas)

- Steel industry
- Mineral- and cement industry
- Pulp- and paper industry

Renewable electricity & heat in CHP processes

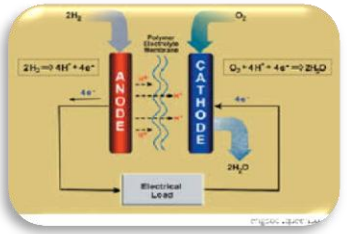
- Energy providers
- Utilities

Feedstock to petro chemical industry (Syngas)

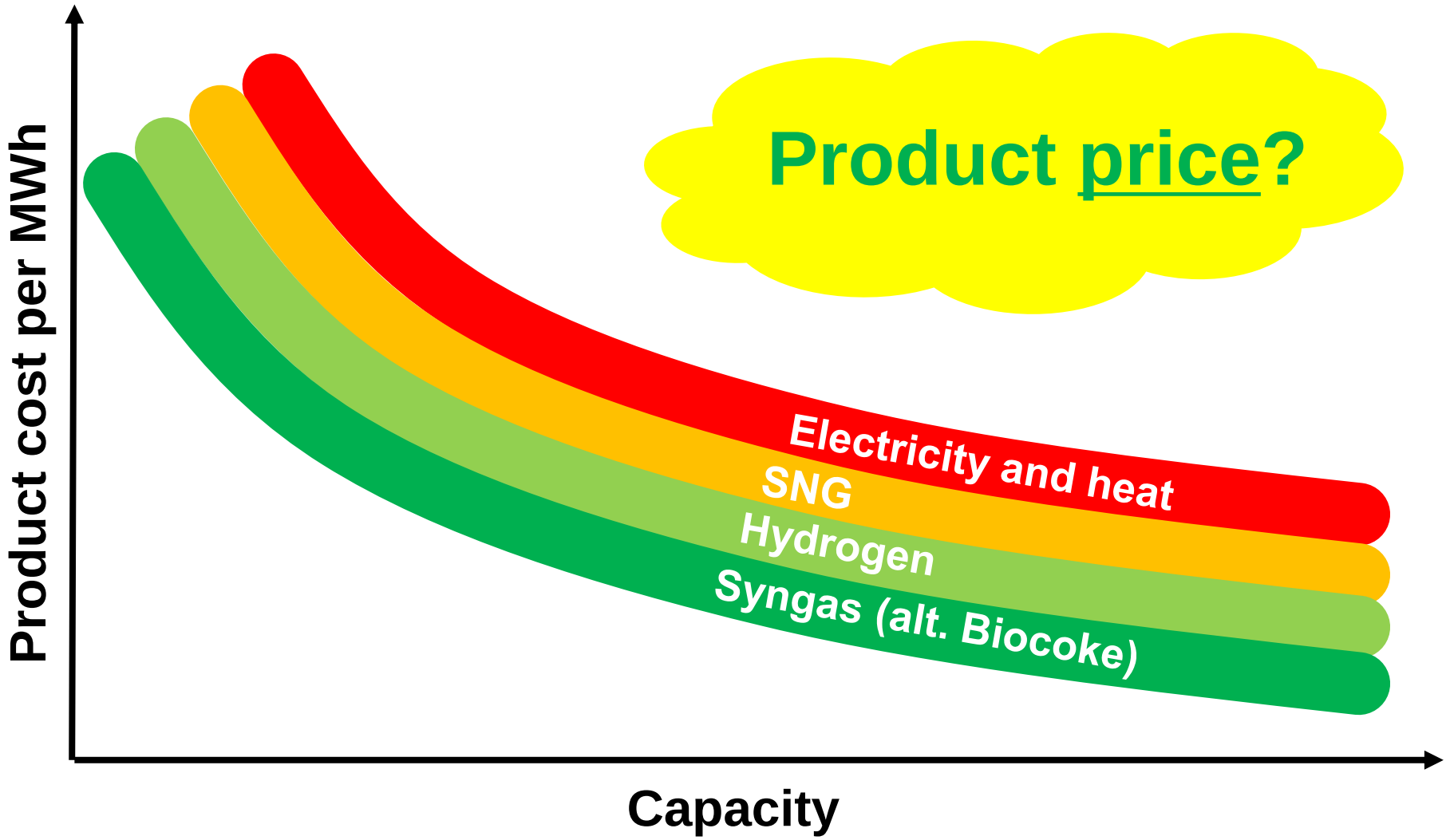
- E.g. Plastics-, paint- and glue industry

Hydrogen for industrial and fuel cell applications

- Both stationary- and automotive fuel cells



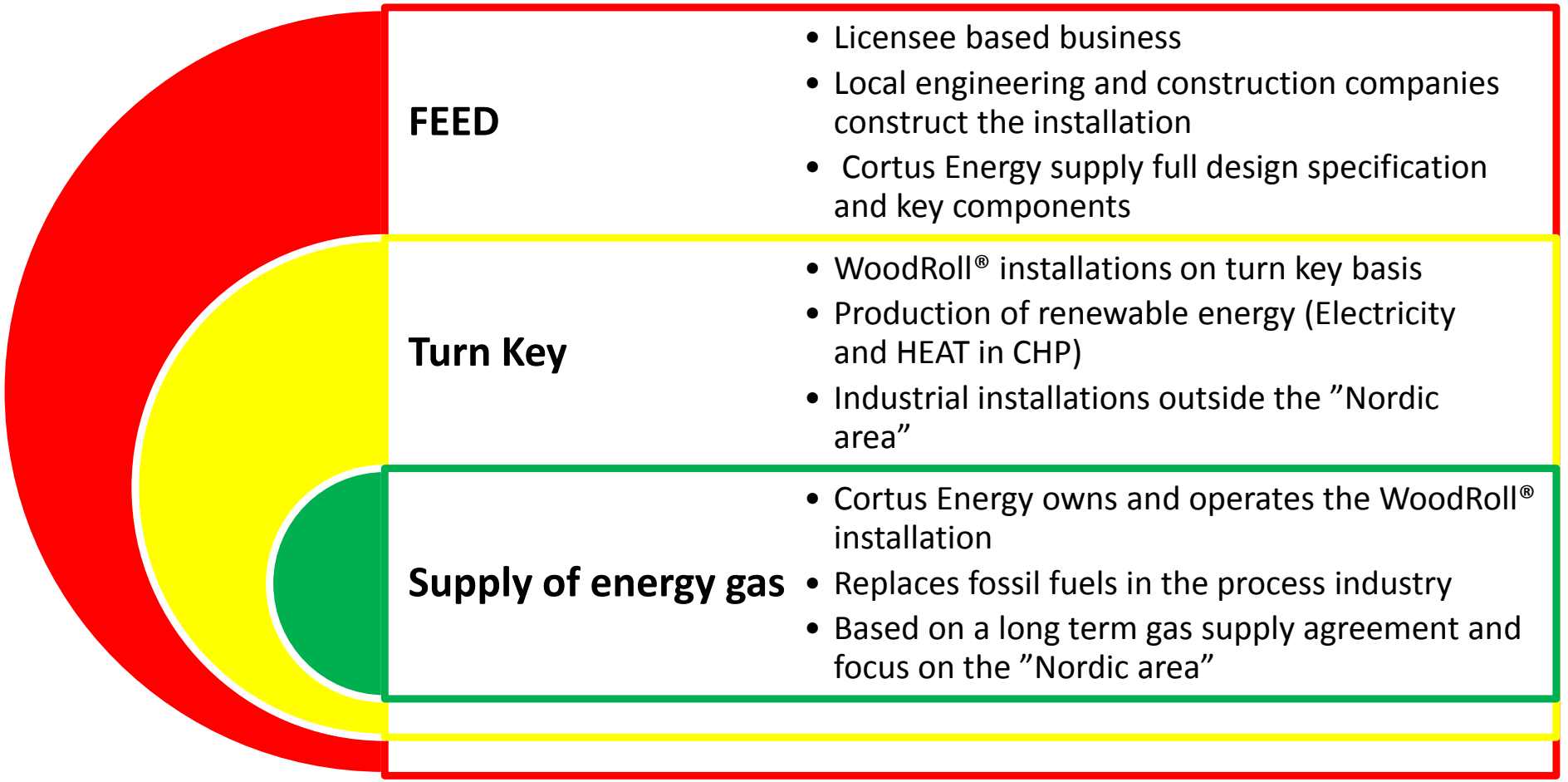
WOODROLL® - PRODUCTS



CORTUS ENERGY AND WOODROLL® - STATUS

- The company was founded 2006 and is listed since 2013 on the OMX stock exchange, Stockholm, Sweden
- The process has been developed and verified in labaratory at Royal Institue of Stockholm, Sweden, since 2006
- A 500 kW prototype test line has been in operation (by test campaigns) since 2011
- The first industrial system of 5 MW to be built 2014 at Nordkalk lime processing plant in Rakke, Estonia
- To be followed by a second larger installation (10 – 15MW) a year later at the same site
- Global large interest for WoodRoll® which has received numerous awards e.g. WWF Climate solver (2009), 25 best companies in Nordic Clean Tech Open (2010), 25 best Cleantech companies at Cleantech Summit in Geneva (2011) and recognized as ”Beyond State of the Art” from German Consulting Company (Germany 2010) and Gas Technology Institute Chicago (USA 2011)

BUSINESS OFFERS



PROJECT PROCESS

CONCLUSIONS AND DISCUSSION

How can WoodRoll® help you?

- Energy demand?
- Cost of energy and its impact on the final product?
- Current type of energy?
- Part renewable energy?
- Fuel supply?
- Financial & Investment (IRR, depreciation period etc)?
- Next step?

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EXTRA MATERIAL

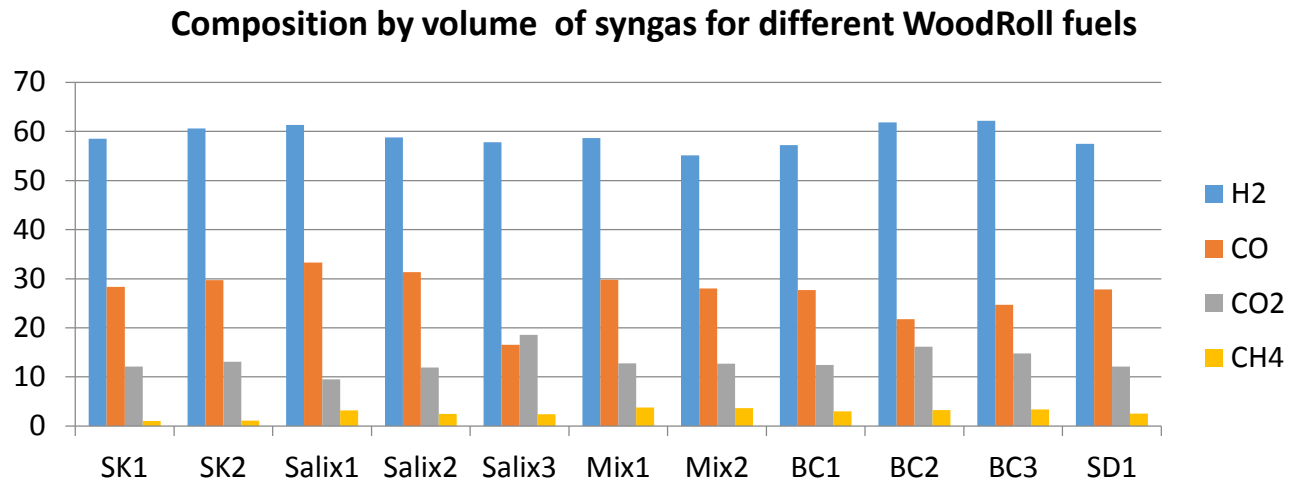
ENERGY GAS SUPPLY SETUP

Back-up

WoodRoll

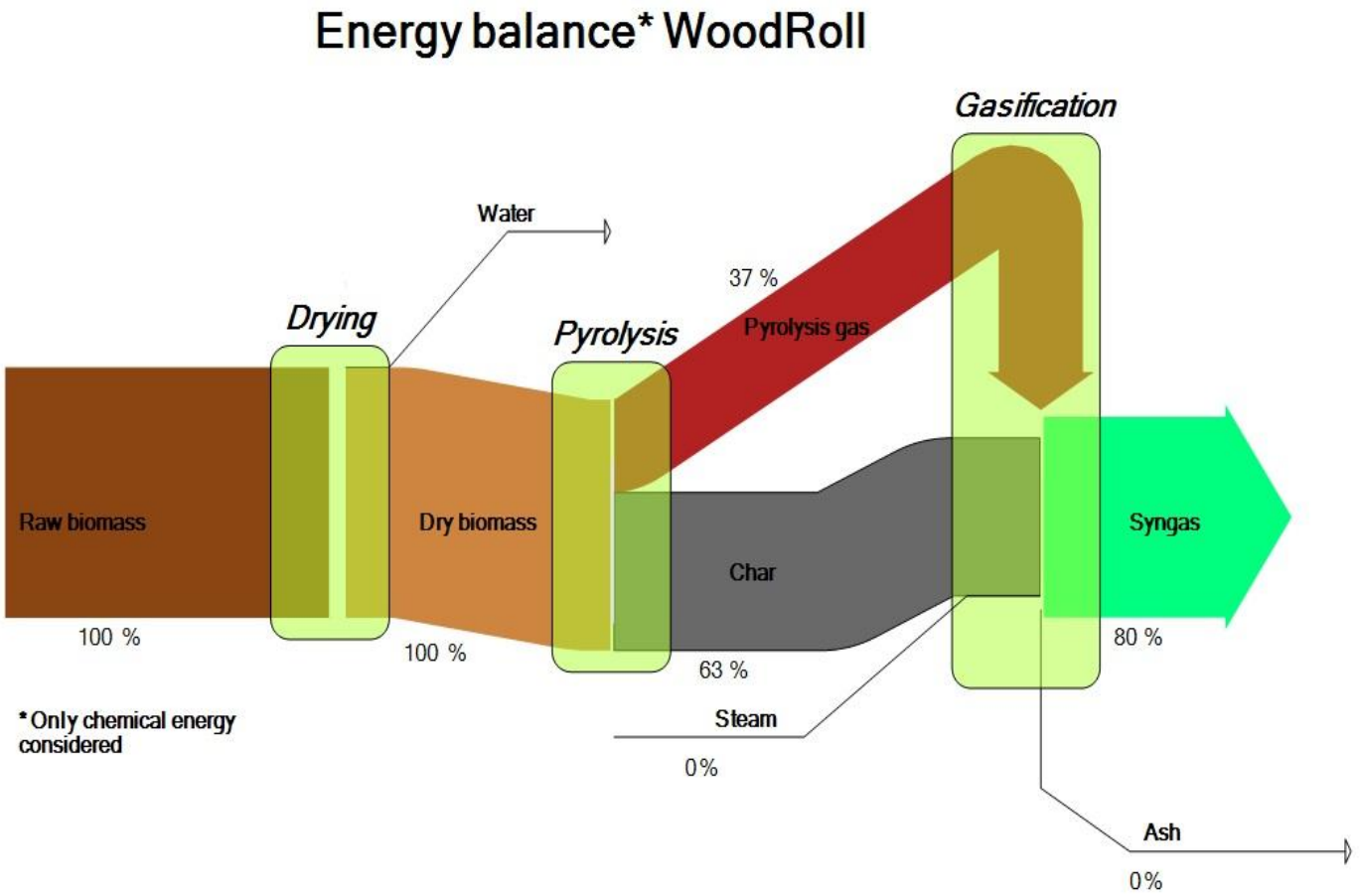
Gas buffer

SYNGAS COMPOSITIONS

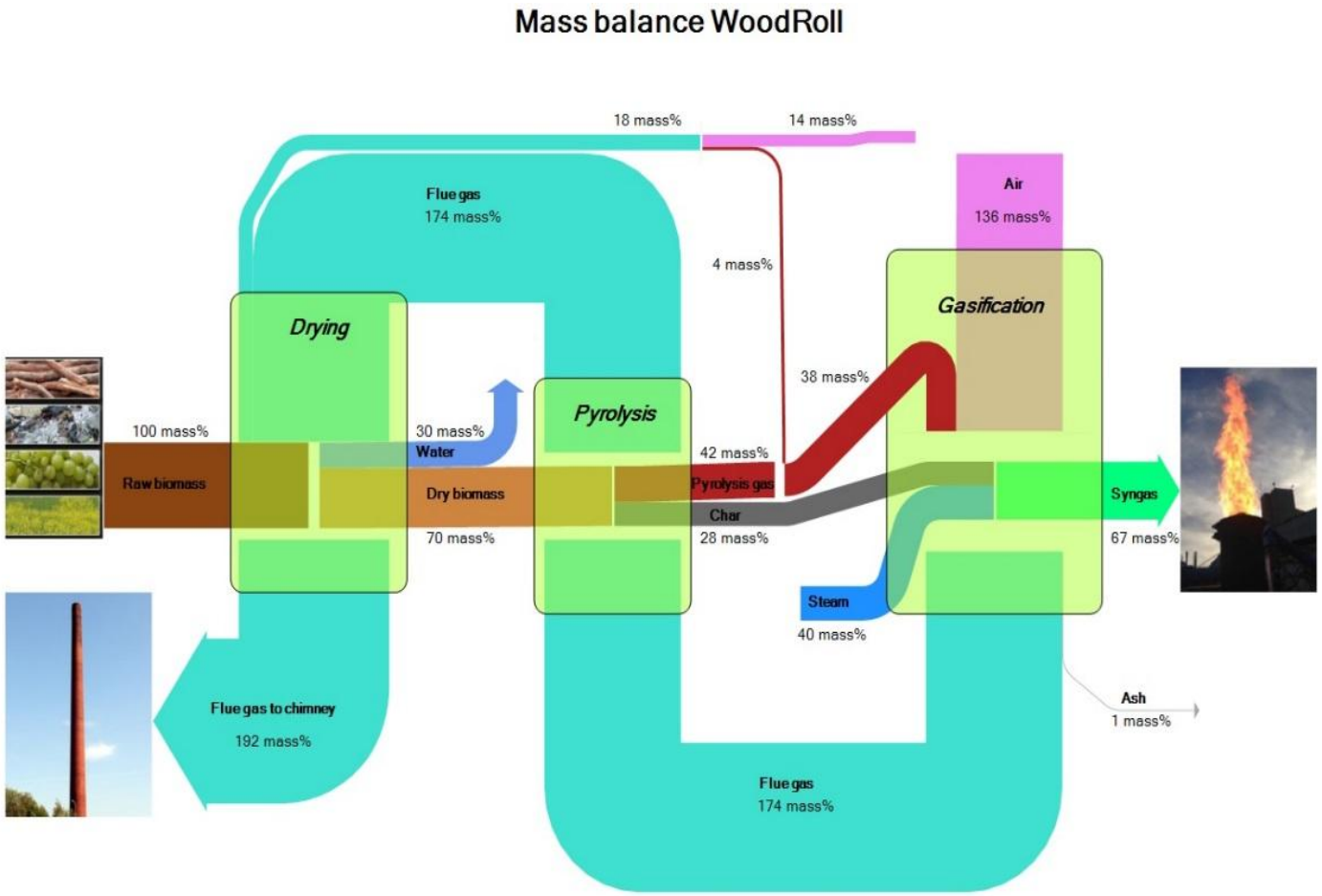


Impurities (after cyclone)	PPM (vol.)
H_2S	< 1
NH_3	10
HCN	< 10

ENERGY BALANCE

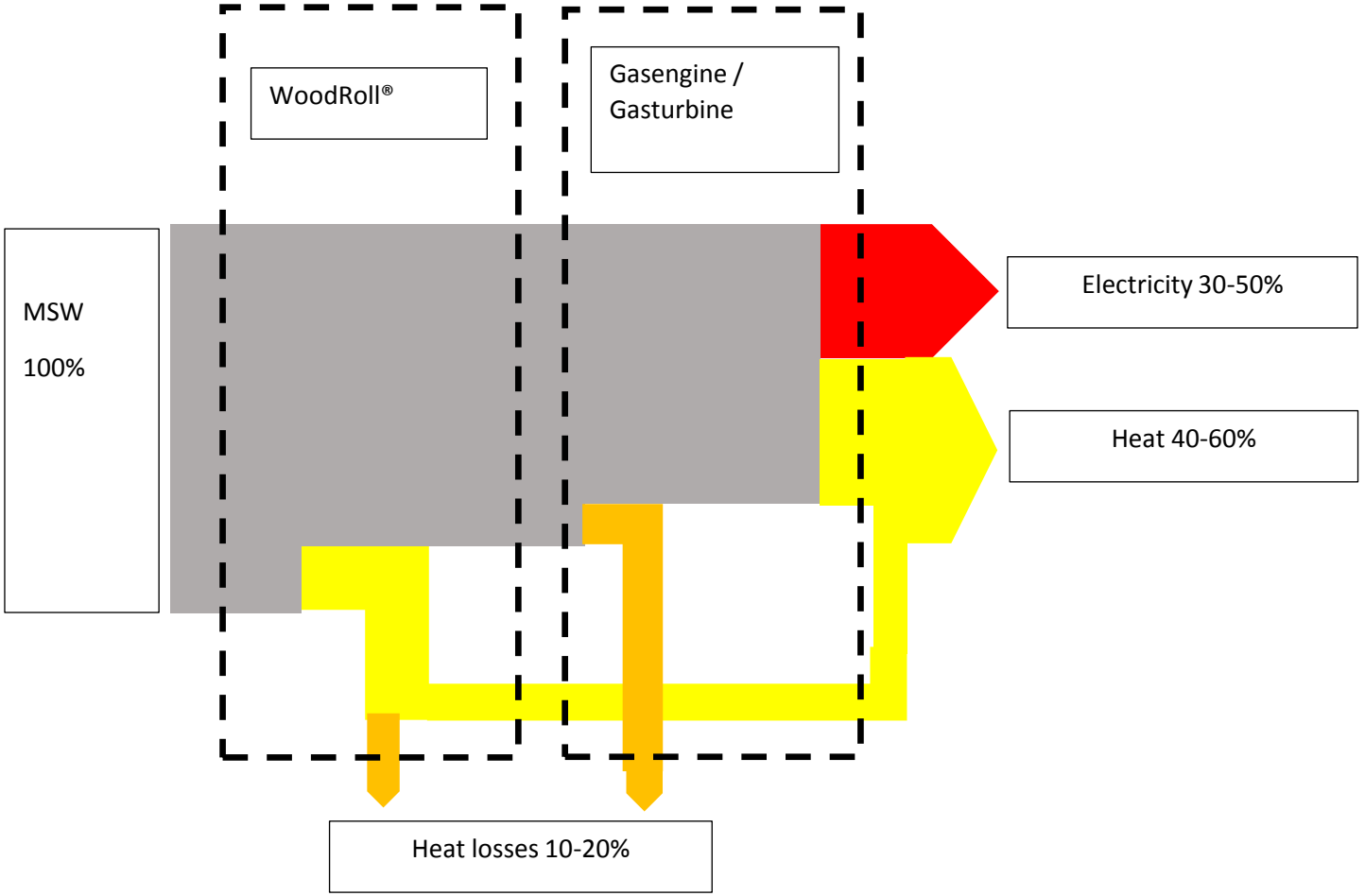


MASS BALANCE

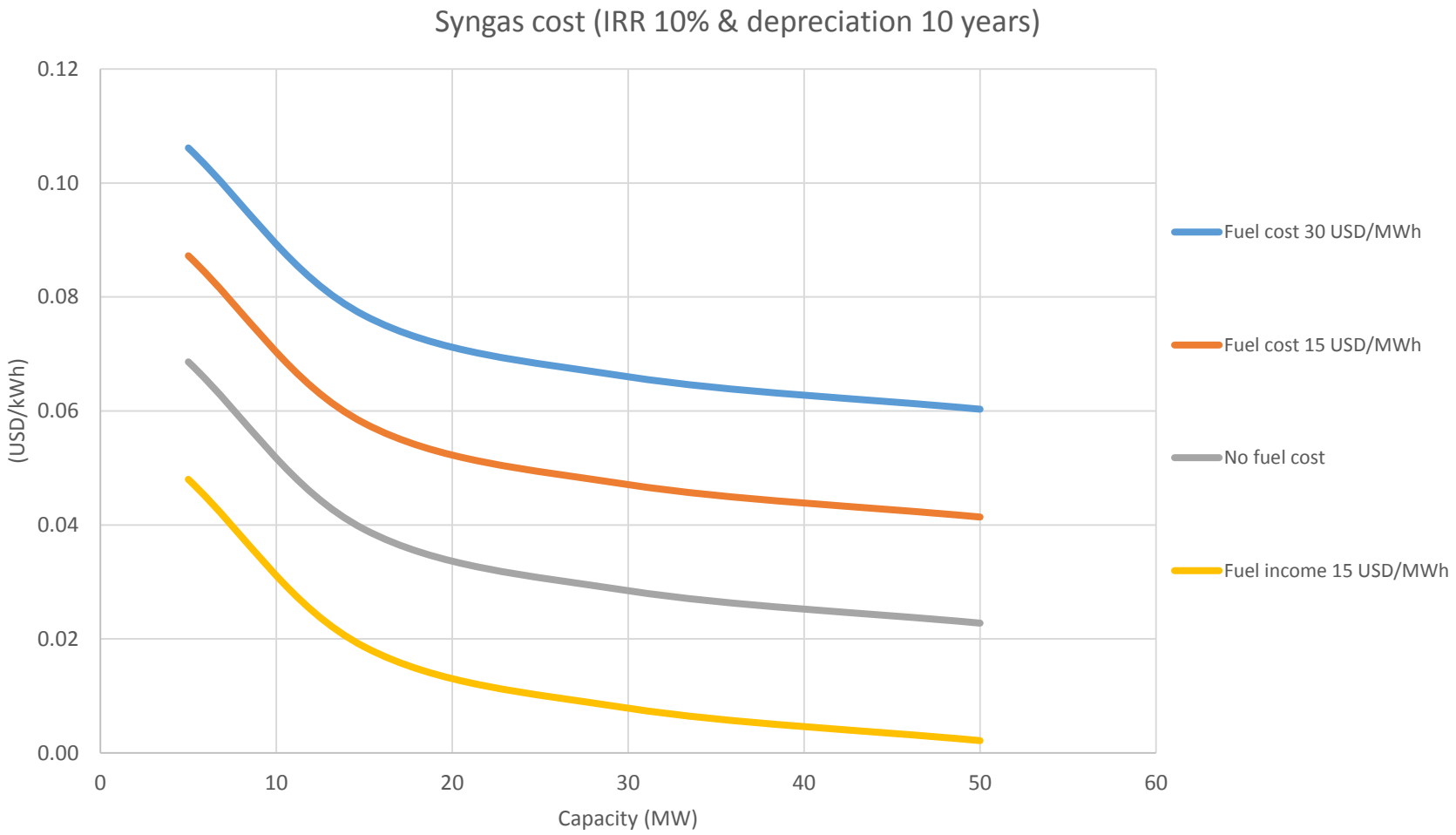


CHP COUPLING

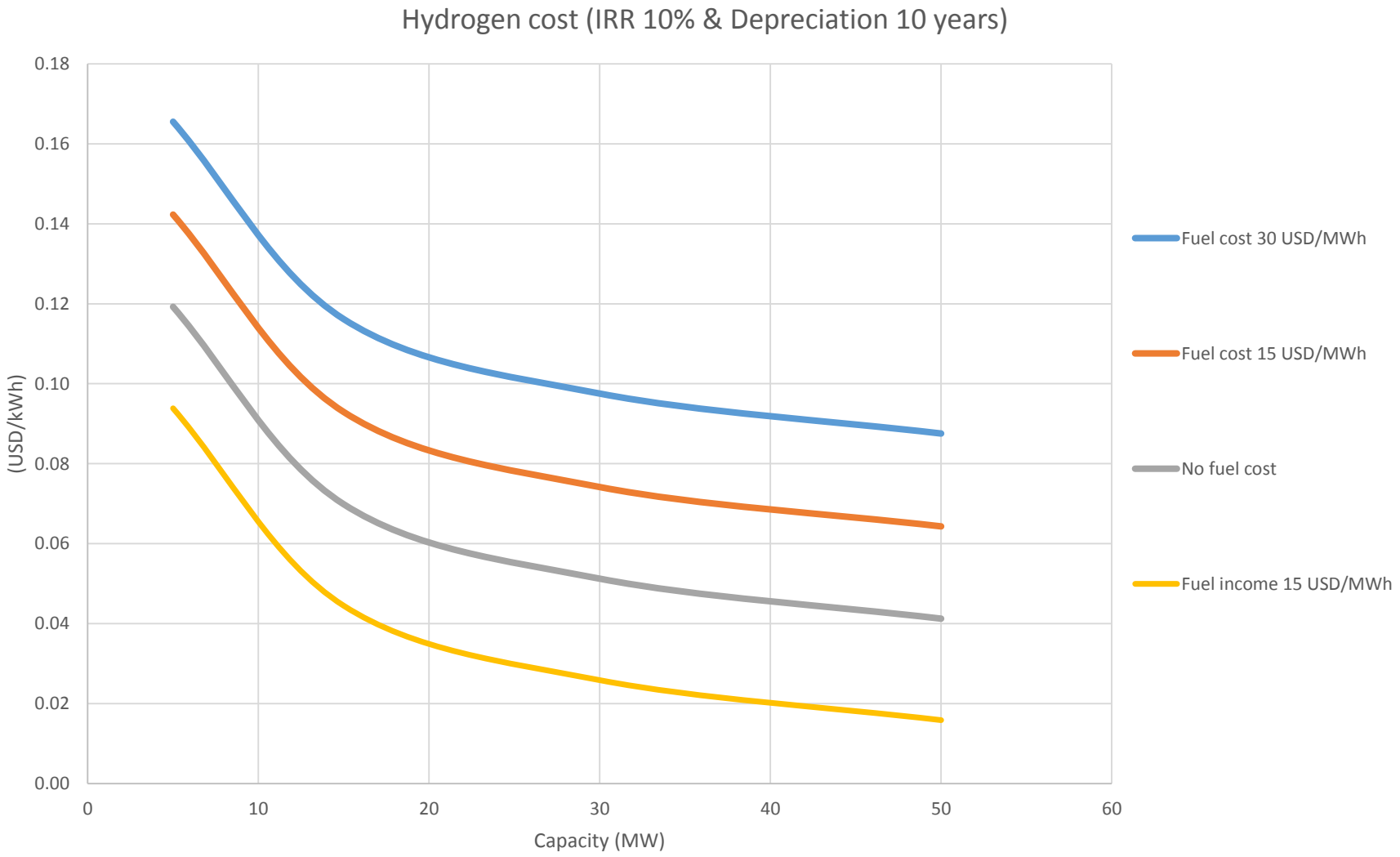
CHP – ENERGY BALANCE



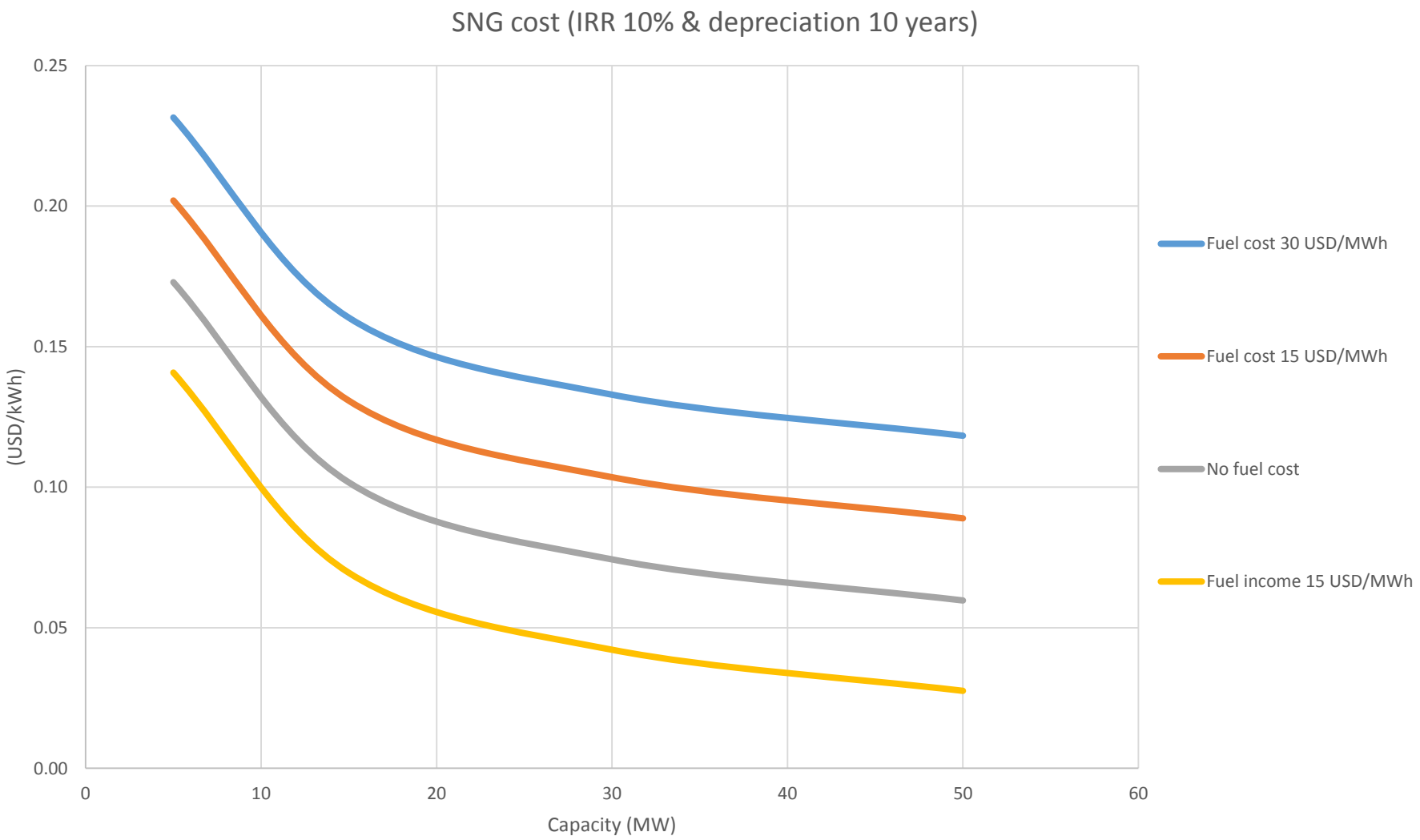
INDICATIVE PRODUCT COST – SYNGAS (&BIO COKE)



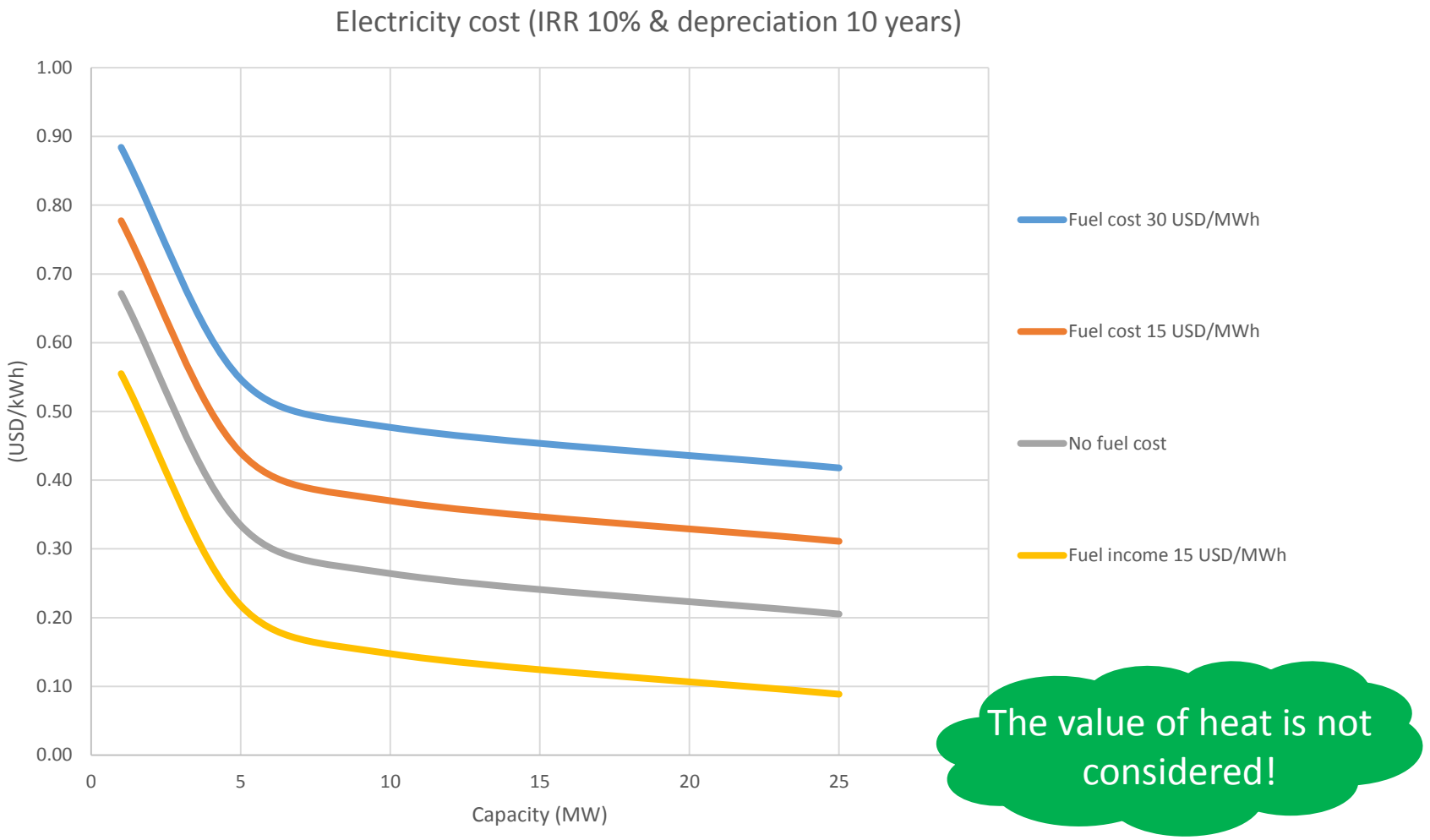
INDICATIVE PRODUCT COST - HYDROGEN



INDICATIVE PRODUCT COST – SNG



INDICATIVE PRODUCT COST – ELECTRICITY



The value of heat is not considered!

INDICATIVE INVESTMENTS PER MW